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SYSTEM REQUIREMENTS

Minimum

Operating System:	Windows XP/2000
Processor:	Pentium III 650 MHz
Memory:	256 MB RAM
Hard Drive:	1.3 GB
Video Card:	DirectX 9.0 supported 3D card with 32 MB of video memory.
Other:	Keyboard and Mouse

Recommended

Operating System:	Windows XP/2000
Processor:	Pentium IV 2.0 GHz
Memory:	512 MB RAM
Hard Drive:	1.3 GB
Video Card:	DirectX 9.0 supported 3D card with 64 MB of video memory.
Other:	Sound Card, Keyboard, Mouse, Joystick and High-Speed Internet Connection or LAN connection.

SETUP AND INSTALLATION

1. Start Windows 2000/XP. Exit all other applications
2. Insert the Wings over Europe CD-ROM game disk into your CD-ROM or DVD drive.
3. If AutoPlay is enabled, the installer will automatically launch. Wait until it finishes verifying the install and follow the onscreen instructions.
4. If AutoPlay is not enabled, double-click on the "My Computer" icon on your Windows desktop. Next, double-click on your CD-ROM drive icon. If the install screen still does not appear at this point, click on the Start button on your Windows task bar, then on Run. Type D:\Setup (NOTE: your CD-ROM may be assigned a letter other than D, substitute that letter) and click on OK.
5. Follow the on-screen instructions to finish installing the game.
6. Once installation is complete, click on the Start button in your Windows taskbar, then select Programs, locate the Wings over Europe folder and click on the Wings over Europe icon to start the game.

If autorun is enabled, the autorun menu will appear with an option to start Wings over Europe whenever the Wings over Europe CD is placed in your CD or DVD drive.

For Wings over Vietnam Users:

Wings over Europe can be installed into Wings over Vietnam as an expansion pack- or as a separate, stand alone product.

If you decide to install Wings over Europe as a separate, stand-alone game- follow the install instructions listed above.

If you decided to install Wings over Europe as an expansion for your previously installed copy of Wings over Vietnam, select that install option during the install process. NOTE: You must have a valid, installed copy of Wings over Vietnam in order to install Wings over Europe as an expansion.

QUICK BASICS

This section provides a short introduction to the major tasks involved with taking off, finding your target, hitting it, and making a successful landing. If you're new to flight simulators, these instructions will help you get started. Even if you're a veteran of flight simulators, you'll find some of the commands in this section useful.

For a complete list of commands, see Default Key Commands at the end of this manual.

Taking Off

By default, you start the game in the air. However, you can change the Mission Start Position setting in the Gameplay Options Screen to start on the runway.

Taking off is relatively simple. Once you receive clearance from the tower, you're ready.

1. Check to make sure the flaps are partially extended for take-off. If not, extend the flap to Take-off setting (press F once).
2. Power up your engine to 100% thrust (press =).
3. Release the wheel brakes (press B).
4. Keep the nose pointed straight ahead using the rudder keys (Comma (,) and Period (.) keys).
5. As you approach the end of the runway, pull back gently on the joystick (Down Arrow key) to lift the nosewheel off the ground at about a 10% angle.
6. After the aircraft lifts off the runway and you start climbing, raise the landing gear (press G).

Navigating

Finding your way around is fairly easy through the use of the Heads-Up Display (HUD).

This section assumes that all Gameplay options are set to Easy or Normal; for Hard settings, you may need to rely on bearings and cockpit instruments to find your next waypoint.

Your waypoints show up in the Planning Map before the mission. During flight, your next waypoint shows up either as a white triangle in your forward view, or as a white cone on the perimeter of your screen. Steer towards it to manoeuvre to the next waypoint. Note that you always have a preliminary waypoint just before the target area or rendezvous point, and just before landing.

You can select the next or previous waypoint to switch them in mid-mission. Be aware that violating the planned flight path can consume precious fuel.

W/Shift+W	Select next/previous waypoint.
A	Activates autopilot and flies toward next waypoint.
Alt+N	Skips forward in time to the next encounter.
M	Display the in-flight map.

Targeting

Your next order of business is to find and lock onto a target. You can do this either by bringing a target into view or using your radar. For guided weapons that require a radar lock, you must acquire a target prior to firing weapons. Even your gunsight relies on your aircraft's targeting system to compensate for range and motion.

Visual Targeting

You can select any target you can see in the front view. A selected target appears in square brackets on the HUD. If the target moves out of view, a cone appears to "point" you toward your current target.

T/Shift+T	Target next/previous air enemy or unidentified target. Depending on your HUD settings, target information may appear onscreen.
Ctrl+T	Target closest air enemy or unidentified target.
E/Shift+E	Target next/previous enemy ground object.
Ctrl+E	Select closest enemy ground object.

Radar Targeting

If your aircraft is equipped with a radar, you can also use the radar to search and track targets beyond visual range.

PgUp/Shift+PgUp	Cycle Radar Mode—Search/Boresight/Ground Map/Terrain Avoidance.
PgDn/Shift+PgDn	Cycle to next/previous Radar Range setting.
Home/Shift+Home	Select next/previous radar target on radar display. Radar must first be in Search mode, and a target must be within radar range.
Insert	Lock on to currently selected target and go to Target Tracking mode.

Using a Weapon

After you have something targeted, you're ready to fire your gun, missile, or rocket or to drop your bomb. Before you can do so, however, you must select a weapon.

Backspace/Shift+Backspace	Switch to next/previous Air-to-Air (ATA) weapon.
Hash (#)/Shift+(#)	Switch to next/previous Air-to-Ground (ATG) weapon.
Spacebar (Joystick Button 1)	Fire primary gun or cannon.
Enter (Joystick Button 2)	Fire/release currently selected missile, bomb, or rocket. (Some guided weapons may require a lock.)

Some weapons require a radar lock, and until lock is achieved, you won't be able to fire the guided weapon. Some heat seeking missiles will sound an audible tone when locked on. You do not have to keep the target in view after launch to hit targets with heat seeking weapons.

For radar-guided weapons, you must wait to fire until you see a solid yellow diamond over the target in the HUD. Whenever you launch a radar-guided weapon, remember that you must keep the target within the cone of your radar's view to maintain the lock.

Weapons such as rockets and forward guns don't require a lock and can be fired whenever you want. Your gunsight is somewhat automated and can help you aim. Just place the red gun reticle over the target and fire at will. The system will automatically compensate for your target's range and help you "lead" the bullets into his path.

Ending a Mission

You may end the mission at any time by pressing the ESC key. However, if you end the mission before your mission is accomplished, it will be recorded as a failed mission. You may, of course, choose to continue to fly back to your home base and attempt a landing.

Landing

Landing is a bit trickier than taking off because you must control both your angle, descent rate and speed. The main instruments you need to observe are the Airspeed Indicator, Altimeter and Vertical Velocity Indicator. Jets land at a high rate of speed, and swept-wing aircraft in particular don't generate a lot of lift at steep angles of attack.

In general, here's what you need to do to land:

1. As you approach the second-to-last waypoint, begin your lineup with the runway.
2. On approach, begin gently reducing your throttle setting to 25% (press -).
3. Press F twice to fully extend your flaps and gain extra lift.
4. Press G to lower your landing gear.
5. Keep the nose angled up at about a 10 to 15 degree angle.
6. Keep your airspeed between approximately 150 and 200 knots and stay on a course aligned with the runway. You should descend at about 500 or 600 feet per minute.
 - a. If you need to slow down, pull back slightly on the stick to raise the nose.
 - b. If you need to speed up, lower the nose slightly.
 - c. If you need to increase your descent rate, reduce the throttle. Conversely, increase the throttle to decrease the descent rate.
 - d. You can also temporarily apply the airbrake to slow down (press S to toggle).
 - e. If you run into real problems, switch on autopilot for a safe landing (press A).
7. At about 100 feet above the runway, flare by pulling back gently on the stick. This lowers the rate of descent and executes a soft landing. (Be careful, as raising the nose too high may result in the engine nozzle hitting the ground first!)
8. After touchdown, reduce throttle to 0% (press -).
9. Engage the wheel brakes (press B).
10. Press ESC to end the mission.

On the Ground

Every successful mission starts with a good plan. Wings Over Europe offers a variety of entertaining mission types, including instant action, single missions, a full campaign and multiplayer games. But before you rush to suit up and get off the ground, you've got to properly equip your aircraft for the task at hand.

Your journey into the skies starts on the ground, beginning with the Main Screen. From there, you select a pilot (except for Instant Action) and a mission type. After you study the mission briefing, you can then memorize your waypoint route and outfit your bird with fuel, bombs, missiles and guns. Finally, you'll be ready to take on the best strategic manoeuvres your foes have to offer.

Screen

The first thing you see when you start the game is the Main Screen. Here, you select the type of mission you want to fly. You can also view statistics for the current pilot or another pilot you've previously saved.

The Main Screen lists the following options. Click a button to access that screen.

Instant Action	Jump immediately into flight in a randomly generated mission.
Single Mission	Load a historical mission, or configure a new mission and fly it.
Campaign	Load the currently active pilot and campaign, or start a new campaign with a different pilot.

Multiplayer	Host or Join a multiplayer game via your Local Area Network or over the Internet (IP address required).
Pilot Record	View vital statistics for all of your saved pilots, or create a new pilot to man your aircraft.
Options	Set options for Gameplay, Graphics, Sound, Controls, Network and other miscellaneous options.
Exit	Closes the game.
	Displays a small menu that allows you to view other screens, see the Credits, and quit the game. The small green aircraft icon in the upper left corner appears on every base screen and has quick links to the Main Screen, Pilot Record Screen and Options Screen. You can also select Quit to close the game.

Instant Action Screen

Jump into the cockpit and quickly engage enemy targets in an Instant Action Mission. When you select Instant Action from the Main Screen, you immediately find yourself high in the air near enemy territory. In some cases, you may even find yourself doggedly evading a bandit who's on your tail. With an Instant Action Mission, you don't get to choose your aircraft, enemies, or setting — it's a surprise each and every time you enter battle. You also don't have to deal with takeoffs and landings. At the end of each Instant Mission — after winning, crashing, or dying — you see the Debrief Screen.

Single Mission Screen

Create and fly randomly generated missions, or fly historical missions. When you click Single Mission in the Main Screen, you're able to set parameters for the mission. Another difference between a Single Mission and Instant Mission is that the results of Single Missions are saved to your pilot's permanent record. You have several options in the Single Mission Screen. The left side of the file folder shows two buttons, and the right side displays the parameters for the selected subscreen.

Create Mission	Configure a new mission. The game remembers the last settings used.
Load Mission	Load a custom mission or a previously saved mission. You can select a previously saved mission from the Mission Filename list.
ACCEPT	Once the mission is configured or loaded to your satisfaction, click ACCEPT to continue to the Hangar Screen.
EXIT	Return to the Main Screen and cancel this mission.

Create Mission

Setting different mission parameters can drastically affect the difficulty of a mission. For instance, it's going to be harder to fly a reconnaissance mission when there is heavy enemy air activity, and if you want to up the ante for your pilot, try setting up heavy enemy air activity and heavy enemy air-defence activity.

You can alter the following options for a new Single Mission:

Aircraft Type	Select an aircraft to fly on this mission - the F-100D Super Sabre, F-105D Thunderchief, F-4B Phantom II, F-4C Phantom II, F-4D Phantom II, F-4E Phantom II, F-4J Phantom II, F-4M Phantom II, A-10 Thunderbolt II, Harrier, Hawker Hunter or F-15A Eagle.
Mission Date	Select a specific year for this mission. Different weapons became available at different dates, so select a later year to make more advanced weapons available. (This applies to both friendly and enemy weapons!)
Mission Type	Select a mission type — Strike, Close Air Support, Iron Hand, or Armed Reconnaissance
Mission Map	Select a specific map and terrain type.
Mission Start Time	Select a time of day for the mission - Random/Dawn/Morning/Noon/Afternoon/Evening/Dusk/Night.
Mission Weather	Set the weather conditions - Random/Clear/Scattered/Broken (partly cloudy)/Overcast/Inclement (stormy).
Enemy Air Activity	Select the approximate level of enemy activity for the mission — Random/Light/Normal/Heavy. This sets the number of airborne enemies you'll likely encounter during the mission.
Enemy Air Defence	Select the approximate level of enemy ground-based anti-aircraft units you'll face during the mission — Random/Light/Normal/Heavy.

Campaign Screen

Participate in a full-length war and fly dynamic campaign missions. The Campaign Screen allows you to start a new campaign mission series, or load an existing campaign that you've created. Once you begin a new campaign, you can't change the pilot you're using for that particular campaign. However, you can start a new campaign with a different pilot.

Two buttons appear on the left side of the screen. When you select one, the right-hand page changes to reflect your chosen option.

Create Campaign	Starts a new campaign. After you choose this option, set the campaign parameters and then click ACCEPT. When prompted, enter a save name for the new campaign.
Load Campaign	Enables you to load a saved campaign. Select the campaign you want to load from the drop-down list on the right-hand side of the screen, then click ACCEPT.

EXIT	Returns you to the Main Screen and cancels the current campaign mission.
ACCEPT	Prompts you for a campaign name and saves the new campaign, then displays the Hangar Screen.

Create Campaign

When you opt to create a new campaign, you can set the following options:

Pilot Name	Displays a list of pilots you've created. Select one to associate that pilot with this campaign. That pilot will still be able to fly Single Missions.
Campaign Name	Displays a list of available campaigns.
Service	Displays the available service branches by nationality.
Unit Name	Displays a list of available squadrons. The list varies, depending on which service branch you select.
Campaign Difficulty	At the Easy level, your success has less effect on the success of other units involved in the campaign war. If you perform poorly, other battle areas can still achieve overall success. The opposite is true for Hard campaigns - your performance guides the overall performance for your side. Normal falls somewhere in between.
Campaign Length	Determines the maximum number of missions for the campaign - Short/Normal/Long. A short campaign ends at about half the normal length campaign (exact mission number varies depending on the campaign, usually around 30) and a long campaign does not end until double the normal number of missions have been played.
Aircraft Supply	Controls how often your base receives supplies, and how many supplies are delivered - Limited/Normal/Unlimited. Limited resupply means that you're much more likely to run out of aircraft and weapons before the next convoy arrives. Normal gives you slightly more aircraft and weapons, and Unlimited means that you never need to worry about running out of supplies.
Weapon Supply	Acts similarly to aircraft supply - Limited/Normal/Unlimited.

Hangar Screen

The Hangar Screen is your pre-flight area. From this area you can review the mission briefing, alter your aircraft's ordnance loadout, view and adjust your mission waypoints, and select a pilot for the mission. The main Hangar Screen page shows an abbreviated mission briefing. Along with your squadron, callsign and aircraft information, it also displays the current date (in game time) as well as planned takeoff, target arrival and landing times. The Hangar Screen contains six buttons, four of which activate subscreens.

Briefings	Displays an extended mission briefing for the current mission, including situational information, an intelligence briefing and detailed mission instructions.
Loadout	Lets you proceed to the Loadout Screen and adjust weapon and fuel settings for up to four aircraft in your wing. You can also customize your aircraft's appearance in the Loadout area and, in some mission types, select the type of aircraft you want to fly.
Planning Map	Shows the Planning Map Screen, where you can view and adjust waypoints. You can also see all friendly and some enemy positions in this area, along with basic aircraft and base information.
Flight Roster	Shows the pilot assignments for this mission.
EXIT	Returns you to the previous screen (Single Mission or Campaign).
FLY!	Puts you into the cockpit and starts the mission.

Briefing Screen

The Briefing Screen is accessible from the Hangar Screen and shows all mission plans and available intelligence relating to your next sortie, detailing your objectives. The information that appears in the Hangar Screen is a summarization of the material that appears here.

Loadout Screen

In the Loadout Screen, you equip your aircraft with ordnance appropriate for the selected or assigned mission type, whether it's a Single Mission or the next mission in a Campaign game. (See Mission Types for information about different types of missions you can fly in the game.) You can view or configure your own aircraft, as well as that of your wingman and any other aircraft flying with you.

The functionality of this screen differs slightly depending on what type of mission you're flying and what branch of the military you choose. Single Missions allow you a little more flexibility than Campaign Missions, since your aircraft, callsign, squadron alignment and aircraft appearance are configurable. (These items are not editable for a Campaign Mission.)

The top right side of the screen has a number of drop-down lists. The lower right side of the screen details the current aircraft weight (calculated by adding the fuel, ammunition and external weapon weights to the raw weight of the aircraft).

You can set the following options in the Loadout Screen for all aircraft involved in your flight. When you're finished with all of the loadouts, click EXIT to return to the Hangar Screen. When you re-enter the Loadout Screen, the settings for your aircraft display by default.

Callsign	Displays a list of each individual member of your flight. Your aircraft is always designated by "1-1", and that of your wingman by "1-2." Select a callsign entry to configure the loadout for that particular aircraft.
Aircraft	For Single Missions, this drop-down list lets you assign an aircraft type to the currently selected callsign. For Campaign Missions, the aircraft type is fixed, but you can adjust loadouts as needed. Also note that in Campaign Missions you start with a limited number of weapon stores and aircraft. Periodically, your base is resupplied with new munitions and aircraft. The best way to ensure that this happens in a timely manner is to successfully complete all escort missions for incoming supply vehicles.
Number	Displays a drop-down list of individual serial numbers for each aircraft of the selected type. This unique number identifies each individual aircraft on the base.
Paint Scheme	For Single Missions, sets the chosen aircraft's paint job. A small sample of the selected scheme appears to the right of this drop-down list.
Markings	For Single Missions, displays a drop-down list of national military air force emblems for your aircraft.
Squadron	For Single Missions, enables you to select squadron markings, which will appear on the exterior of your aircraft. In a Campaign game, your squadron is predetermined.

Planning Map Screen

The Planning Map Screen shows an overhead view of the mission area, complete with colour-coded icons that represent friendly and enemy units. You should use this screen to become familiar with the navigation layout of the mission, the enemy line, and the type and number of known foes.

The map shows the following elements of information for each mission. You can click-and-drag anywhere on the map to scroll in any direction.

Chalkboard	Displays basic information about the mission, target area and base. This area also displays waypoint and unit information, as described below. Blue icons represent friendly air and ground units, and red icons denote enemy units. The type of unit appears as an image on top of the icon. When you move the cursor over a friendly or enemy unit icon, known information about that unit appears on the chalkboard, including the unit type, number of
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units, and home base. As you win more Campaign Missions and gather more intelligence, you'll be able to spot more targets and view more information about them in this screen.

The small yellow triangles indicate waypoints for your flight. All aircraft flying with you follow these waypoints. Although the set waypoints are optimal for the mission, you can click-and-drag these waypoints to different locations. Be aware that extending the mission path requires additional fuel. Whenever you move the mouse pointer over a waypoint triangle, details about that navigation point appear on the chalkboard.

Battle Line The red jagged line on the terrain indicates the front line of battle. As you progress through the Campaign, this line will move to reflect your success or failure.

Target area The black circle surrounds the area containing the main mission target. If you're having trouble winning a particular mission, you can try entering the target area from a different point.

The magnifying glass icons allow you to zoom the map view in (+) and out (-). The icon with the dashed outline re-centres the map over the target area.

EXIT Returns you to the Hangar Screen.

Pilot Roster Screen

The Pilot Roster screen lists the current game date, as well as the type of aircraft being flown and the names of all pilots involved in the current flight. Pertinent information about each pilot's experience, success, and current condition also appears here. Note that pilots not involved in this mission do not appear on this screen.

Click EXIT to return to the Hangar Screen.

The following information displays for each pilot:

Pilot	Shows the pilot's first name, last name and current military rank.
Combat Missions	Displays the total number of combat missions flown by the pilot.
Kills	Tallies the number of Air-to-Air (A/A) and Air-to-Ground (A/G) kills made by the pilot.
Status	States whether the pilot is available for duty or not. During a Campaign game, the game tracks the status of all pilots in your squadron. As they get shot down, they can become KIA (killed in action), MIA (missing in action), or POW (prisoner of war) and will no longer be available to fly the mission. Pilot replacements arrive on a semi-regular basis.

Morale	Describes the current morale level for the pilot.
Condition	Describes the current physical condition of the pilot - Exhausted, Normal, Rested and Refreshed. Refreshed is the highest level available.
Aircraft Assigned	Lists the callsign for the pilot's current aircraft assignment.

Debrief Screen

Anytime you complete a mission, die, or press ESC, the Debrief Screen appears. From here you can view your score for the mission, the length of the mission, the success/failure message, and a Top 10 score list. You will also view any new medals you receive as a result of earning points for that mission.

You have several other options in this screen. From any other post-mission screen, you can click Debrief at any time to return to the mission summary.

Stats	Shows who fired what weapons during the course of the mission, the number of launches/rounds, the number of successful hits, and the percentage rate of success. Finally, a kill tally also appears for each pilot involved in the mission.
Log	Here, every event that occurs during the mission is logged and timestamped.
REFLY	Fly this same mission again.
ACCEPT	Save the mission score for the currently selected pilot and return to the Main Screen.

Following stats appear for the selected pilot:

Rank	Shows the current military rank. As you earn points with this pilot, you earn medals and advance in rank.
Score	Shows the cumulative score. You receive points for each mission based on success in achieving the objectives.
Rating	Overall rating of the pilot.
Total Kills	Shows the kill tally (number of enemies destroyed).
Air-to-Air	Breaks out the number of aircraft kills.
Air-to-Ground	Breaks out the number of ground unit kills.
Flight Hours	Shows the total hours flown by this pilot.
Missions	Displays the total number of missions flown.
Success	Breaks out the number of successful missions.
Avg. Rating	Displays the pilot's average rating for non-Campaign Missions.
Campaigns	Shows the total number of campaigns flown.
Success	Breaks out the number of campaigns won by this pilot.
Avg. Rating	Displays the pilot's average rating for Campaign Missions.

Options Screen

Adjust various game settings such as gameplay, graphics, sound, and controls options. You can change many of the game's options by setting them in the Options Screen. To access the options from anywhere in the game (prior to flight), simply click the green aircraft icon in the upper left corner of the screen, and then click Options.

Note: You cannot reset Options while you're airborne.

You have access to the following Option Screens - Gameplay, Graphics, Sound, Control, and Network. Click on the name of a section to jump to that option category.

EXIT	Takes you back to whichever screen you were in prior to accessing the Options Screen.
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Gameplay

The Gameplay screen lets you change settings that affect how hard or easy the game is to play.

Mission Start Position	Position of your aircraft when the mission starts - Near Target/Air/ Runway. This determines whether you begin the game in the air or not, and how close you are to the target objective.
Default Viewpoint	Your perspective when the mission starts - External/Cockpit. An external view positions you so that you see the outside of your aircraft; a cockpit view seats you behind the controls. See Key Commands later in this manual for details on how to change camera views.
Enemy Skill Level	Skill of your opponents - Easy/Normal/Hard. Easy: Enemies aren't all that accurate - they'll fire less often and miss more often. Also, their flying skills are below average. Normal: Opponents are a slightly better shot at range and are better at executing combat manoeuvres. Hard: Opponents are seasoned veterans who pick their shots carefully and are fairly accurate. Dogfighting these enemies won't be an easy task, offensively or defensively.
Simulation Difficulty	Overall difficulty of the game, based on a number of option settings - Easy/Normal/Hard/Customize. Click Customize to display additional drop-down menus and options (listed below). For all of the customizable options, you may select Easy/Normal/Hard. The default setting is Normal.
Flight Model	Controls the flight model for the aircraft. Easy: Arcade-type flight model. You have a lot of flight control due to limited external aerodynamic forces and the aircraft flies where the nose is pointing.

Weapon Effectiveness

Normal: More accurate flight model. No true stalls or spins exist, but you must deal with some external aerodynamic forces.

Hard: Most complex flight model. External forces can cause you to stall out or enter an unrecoverable spin. Realistic flight control limits make the diagonal motion of the joystick less useful for rolling during high angle-of attack (AoA) manoeuvres.

Controls behaviour and realism of weapons.

Easy: Guns and weapons are very effective. Even the nose cannon can penetrate armour. Weapons have a wide blast radius and will not malfunction, so you need less accuracy when aiming at targets.

Normal: Cannon rounds will still puncture armour, but otherwise guns and weapons do realistic damage.

Missile launch parameters exist, and missiles may malfunction if fired outside of those parameters.

Hard: Gun and cannon rounds observe armour resistances, so attacking the front of a tank with a gun is not going to be effective. Strict missile parameters exist. Some missiles have a built-in, realistic firing delay of up to two seconds.

Radar Display

Controls the realism of the radar control and display. Easy: Radar automatically marks targets as friendly or enemy. You have a 360-degree view of the area with no blind spots.

Normal: The radar has a limited forward front view and uses realistic ground clutter and return signals.

Targets remain on the radar screen as long as they remain in the cone of view. The radar automatically tracks targets as soon as they move into radar range.

Hard: The radar realistically displays targets as momentary blips. It can take 6 seconds or longer to enter tracking mode, depending on the strength of the radar signal and the proximity of the target.

Visual Targeting

Controls how targets are identified and selected.

Easy: You can target anything, even things you cannot see, and all targets are marked as friendly or enemy.

Normal: You can only target objects that are within visual range and not obstructed by mountains, clouds or other objects. All targets are marked as friendly or enemy.

Hard: Target identification does not automatically occur, and you must fly close enough to an object to determine whether it is friendly or enemy. You can only target objects currently in your viewing range.

HUD Display

Controls how the Heads-Up Display (HUD) operates. Easy: All available information displays on the HUD, including flight information, target information and waypoints. The targeting square shows the target's type, alignment and range.

Normal: You can only view target flight information when you have the target within proper radar range. The targeting square doesn't show the target's type, alignment, or range.

Hard: Your flight information and waypoint information are the only elements that display on the HUD. Target information does not appear.

Landing

Controls how difficult it is to land the aircraft.

Easy: If you lower the gear, you land successfully.

Speed and angle are not factors in landing success.

Normal: If you lower the gear and don't come down too steeply or too fast, you land successfully. If the descent rate is too high, however, you may crash.

Hard: You must descend at the correct angle and speed to make a successful landing. Violating landing parameters may result in gear damage or collapse, or even worse, a crash.

Collision

Controls mid-air collisions and collisions with the ground.

Easy: You cannot collide with another aircraft in the air. Also, crashing into the ground doesn't do any damage.

Normal: You cannot collide with friendly aircraft, but you can hit an enemy.

Colliding with the ground does reduced damage.

Hard: You can collide with both friendly and enemy aircraft. If you crash into the ground, you will probably die.

Blackout

Controls physical effects of gravitational forces (g-forces) that occur as a result of quick turns.

Easy: Black-out and red-out never occur. You can push or pull as many negative or positive gs as you like.

Normal: You may experience red-out and black-out during excessive g-forces. However, the effects are short-lived.

Hard: Black-outs and red-outs occur under realistic circumstances, and the side effects remain active longer.

Ammo Usage

Controls the rate at which ammunition is expended.

Easy: You have an unlimited supply of gun ammunition, cannon rounds and missiles.

Normal: You can run out of ammunition and armament, but you start out with twice as much.

Hard: You carry a realistic amount of ammunition, and you can only use your guns for a few short bursts.

Fuel Usage Controls how quickly the aircraft consumes fuel.
 Easy: Your fuel supply is infinite, even when you use afterburners.
 Normal: Fuel is consumed at half of the real-world rate during flight, and slightly less than the real-world rate when using afterburners.
 Hard: Fuel consumption is realistic, and you can't use afterburners very much without risking a fuel shortage later in the mission.

Graphics

The Graphics subscreen allows you to change options that affect video settings. In general, the fewer textures and less detail you specify, the better the game performance. Older, slower machines operate best at lower graphical settings. If you have a top-end system, you can leave everything on the highest setting and enjoy increased video quality. Medium settings are generally recommended for machines that meet the minimum system requirements. However, if the video is jerky or slow, try disabling some of these settings or lowering the detail levels.

Display Device Specifies which video card the game should use.
 Normally only one video card will be listed here. If multiple cards appear, choose the option that corresponds to your 3D video card.

Display Resolution Sets the resolution for your monitor during gameplay.
 The dot-per-inch options that appear here are different, depending on which video card you have installed. If you're having performance problems, you can reduce the game's resolution setting.

Lens Flare Sets whether or not you see a blinding "lens flare" effect (multiple halos) when you are flying in the direction of the sun. Your options are as follows - Always On/On External Views/Always Off. Choosing the second option means that you won't see any lens flares while viewing action from inside the cockpit.

Graphics Detail Level Affects the level of graphical detail you see during flight. Click Customize to display additional drop-down menus and options (listed below). These settings greatly affect frame rate.

Object Detail Controls level of detail and distance limits for 3D objects:
 Low: Fewer polygons exist for each object. Some visual effects such as reflections and decals are turned off.
 Medium: Objects have more art polygons and appear more detailed at close range.
 High: Objects appear highly detailed both at range and up close. All visual effects and decals are turned on.

Object Texture Controls the level of texture detail for objects:
 Low: Object textures are limited to 128x128 detail.
 Medium: Object textures are limited to 256x256 detail.
 High: Object textures have unlimited detail.

Cockpit Texture Acts identically to object textures, but applies only for the 3d virtual cockpit model.

Cockpit Mirrors Toggles the rearview mirror on/off. When active, this option significantly slows down your frame rate.

Cockpit Reflection As above, but toggles the transparent, interior cockpit reflections on the canopy glass on/off.

Shadow Effects Detail Toggles object shadows on/off.
 Controls the detail level for special effects, such as smoke, fire and explosions:
 Low: Visual effects are short-lived and don't have much particulate detail.
 Medium: Particle effects are denser, and visual effects last longer.
 High: All effects are shown at full detail, and the effects remain onscreen longer.

Terrain Detail Controls how detailed the terrain appears at various distances:
 Low: Terrain is represented as a simple mesh. No visual noise effects are used, and water effects are turned off.
 Medium: Terrain shows more hills and valleys, and the terrain has more detail and visual noise.
 High: Recommended only for systems with over 256MB memory, this setting displays all terrain effects at their highest detail.

Terrain Texture Controls the level of texture detail for terrain:
 Low: Object textures are limited to 128x128 detail.
 Medium: Object textures are limited to 256x256 detail.
 High: Object textures have unlimited detail.

Horizon Distance Determines the distance to the horizon - Near (45km)/Normal (60km)/Far (75K). Note that this only affects terrain. Enemy object and aircraft visibility distances are not affected.

Ground Objects Controls how many objects (such as trees and buildings) appear on the ground.
 Low: Only important ground targets and buildings are displayed.
 Medium: Some trees and non-mission critical buildings also appear.
 High: All trees and buildings appear on the ground.

Sound

The Sound subscreen lets you change audio options for the game and any external speakers you have attached to your computer.

To adjust the volume slider bars, click on the desired part of the bar. You can also click-and drag the slider left to reduce volume or right to increase volume.

- Sound Volume Adjusts the main master sound level for the game.
- Speech Volume Changes the volume of in-flight radio conversations.
- Music Volume Changes the volume of the in-game music.
- Sound Channels Sets the number of sound channels to use - 8/16/24/32. The higher the setting, the richer the sound.

Stereo Speakers Setup Sets the speaker direction - Normal Stereo/Reverse Stereo. Switch the setting to reverse the left and right speakers in the game.

Speech Subtitles Toggles subtitles on and off for all radio speech.

Control

The Control subscreen lets you adjust your joystick's sensitivity and deadzone settings.

- Joystick Sensitivity Changes how responsive your joystick is to movement. Slide the bar left to reduce sensitivity, or right to increase sensitivity.
- Joystick Deadzone Adjusts the non-responsive area of the joystick around the centre position. Slide the bar left to reduce the amount of "dead" space or right to increase it. A low deadzone value means that a slight joystick movement has a greater effect on your movement than the same movement with a high deadzone value.
- Customize... Change key mappings in this screen. The default control list is loaded by default, but you can click Customize to change the key mappings. If you choose Customize, a new *.INI file will be saved in the Controls subdirectory under the main game folder. You can then select the control list you want by clicking the drop-down list and choosing a key mapping option.

FLIGHT BASICS

This section covers the basic forces that operate on your aircraft and gives an overview of the cockpit and its instruments.

Forces

Four forces operate on all aircraft: Lift, Gravity, Thrust, and Drag. It is the combination of these forces that allows a plane to fly.

Lift keeps an aircraft airborne, and is mostly generated by airflow over and under the wings. A lot of factors are involved in how much lift is present at any given moment, including a plane's airspeed, the shape and position of its wings and their angle of attack. Gravity, on the other hand, is always constant and is the force counteracting lift, trying to pull an aircraft straight towards earth, no matter its orientation. The balance between these two determines whether an aircraft ascends or descends in level flight.

Thrust propels an aircraft forward and is adjustable by throttle. In jets it is generated by turbojet engines and afterburners, if so equipped. It is counteracted by Drag, the amount of friction a plane's shape must overcome when flying through the air. Thrust and drag are affected by a number of factors, including air density, which is variable at different altitudes.

Axes of Movement and Controls

Aircraft have three axes of movement: Pitch, Roll, and Yaw. Each has a corresponding flight control surface. Sufficient airflow over these control surfaces allows a pilot to "steer" a plane in an individual or a combination of axes.

Pitch is the angle of the nose of a plane relative to the ground and is controlled by an elevator or an all-moving horizontal stabilizer (found to be more effective as aircraft approached high subsonic and supersonic speeds). Elevators and moving tail surfaces are found at the rear of an aircraft and are controlled by pushing the flight control stick forward or pulling it backward. This is the quickest and most effective way to make your plane's nose point up or down.

Roll is a rotating movement on the longitudinal axis running through the centre of a plane from front to back, also known as bank. When an aircraft banks, one wing rises and the other lowers. Roll is operated by ailerons, found on the trailing edge of each wing. These are activated by pushing the flight stick from side to side. If you want to change your aspect from right side up to inverted - or any position in between - use the ailerons.

Yaw is movement of the nose on a horizontal plane, much like the steering of a car. Yaw is controlled by the rudder, a vertical airfoil found on the tail of a plane. It is operated by a set of pedals, which also control the nose wheel when on the ground. In aircraft with a high sweepback to the wings, the rudder can also be used to initiate roll when the wings are at a high angle of attack and ailerons prove ineffective.

Inertia

Following Newton's First Law of Motion, which states that "an object at rest tends to stay at rest and an object in motion tends to stay in motion," objects also naturally resist a change of state to their motion (velocity); this resistance is called Inertia. The more mass that an object has, the greater the effect of inertia. How this applies to aircraft is that they will tend to resist a change to their path of movement, despite the pilot moving the controls. That is, the vehicle's momentum will want to continue to carry it along the original path of its centre of mass. While an aircraft's orientation in space may change, its actual flight path may lag behind where the aircraft is pointing, and it can take a while for the plane to "catch up" to its new heading. The higher the velocity, and the greater the mass, the more evident this is. Unless you have chosen to use the Easy flight model, remember that an aircraft isn't like a train on rails that will instantaneously go exactly where it's pointed. You have to take into account its inertia. This is especially important if you are planning on making wild manoeuvres with a full bomb load or at high speeds!

Angle of Attack

On the pitch axis, the difference between where the nose is pointed and where the plane is actually travelling (its velocity vector) is called the Angle of Attack (AoA). Often times even when the nose appears level with the horizon the aircraft may still be ascending or descending according to how much lift is being generated by the wings.

By increasing the Angle of Attack, both more lift (up to a point!) and more drag are generated. Unfortunately, this added drag will have a degenerative effect on speed, and this in turn decreases lift. The deceleration can be counteracted by applying more throttle if there is more power available and, when used on the vertical plane, thrust combined with lift can overcome the force of gravity. As you can imagine, it's all a delicate balancing act!

Slip Angle

On the yaw axis, the difference between where the nose is pointing and where the plane is actually travelling is known as the Slip Angle. Having a high slip angle greatly increases drag, as airflow slams into the side of the aircraft rather than parting around it. In combat it can sometimes be useful to momentarily have a high slip angle to bring the nose to bear on a target.

Lift Vector and Bank Angle

Lift is generated by wings at an angle roughly perpendicular to where they attach to the aircraft, originating from its centre of mass. The direction in which lift occurs is called the Lift Vector. In level flight this is straight up, away from the ground, and directly opposite to the force of gravity. By rotating on the roll axis, the lift vector no longer remains in precise opposition to gravity, and the balance between the two is disturbed. With less lift opposing gravity, the plane naturally loses altitude. In flight pilots often anticipate and counter this loss by pointing the nose slightly above the horizon when banking. The degree to which the lift vector varies from the direct opposite of the force of gravity is called the Bank Angle.

Stalls

Stalls occur when there is not enough airflow over the wings to generate lift. The higher an aircraft's speed, the more lift it creates; conversely, the slower it travels, the less it generates. Eventually, it can slow down enough that lift no longer counteracts the force of gravity, and the plane will simply drop. This is known as a low speed stall and the velocity at which it happens will vary between designs of aircraft. The only way to recover from such a situation is to increase speed so that lift can once again be generated by the wings. A low speed stall close to the ground can be especially deadly, since there may not be enough time or altitude to recover.

Stalls can also occur at high speeds. Generally speaking, the greater a wing's angle of attack, the more lift it generates. There comes a point, however, where the angle of the wing is sufficiently steep that airflow over it becomes disrupted and so turbulent so that the wing can no longer create lift, despite a high velocity. This is known as a high speed or an accelerated stall. Easing off back pressure on the stick, thereby decreasing the angle of attack of the wing, will allow proper airflow to once again resume and lift will be restored. High speed stalls most often happen during violent manoeuvres.

Sweptback Wings

Many of the fighter planes modelled in Wings Over Europe have a high sweepback to the wings. Sweepback was first utilized by the Germans during WWII with their revolutionary Me-262 jet fighter, and it was subsequently discovered to be vital for aircraft that would be travelling at high subsonic and supersonic speeds. Highly swept wings require a higher angle of attack to produce the same lift as straight wings, but this is a fair trade off for the higher speeds they allow. They also don't share the same stall characteristics. As they reach higher and higher angles of attack, the rate at which lift increases actually declines; finally, lift itself actually decreases without the sharp break that happens with traditional wings. Furthermore, at particularly high angles of attack, the rolling effect produced by ailerons is significantly reduced and can actually create adverse yaw effects that can only barely be countered by the rudder. Therefore, in this particular situation, using the rudder and sideslipping creates more roll and proves more effective than using the ailerons, known as "dihedral effect."

Mission Types

Sweep

Fighter sweep missions involve clearing the skies over a specific area of enemy aircraft.

Strike

Strike missions involve attacking enemy surface targets either in close support of ground forces or to knock out defenses and other targets deep behind enemy lines. Specific Air-to-Ground ordnance suitable for the target is almost always required and is only to be jettisoned when directly attacked, likely preventing any possibility of mission success.

MiG CAP

MiG CAP missions involve flying in support of other attack aircraft and intercepting any enemy aircraft that attempt to foil the attack aircraft's mission.

Close Air Support (CAS)

Close Air Support means to engage enemy ground units close to, and in support of, friendly ground forces from the air. CAS missions are often directed by Forward Air Controllers (FAC) and are closely integrated with friendly ground units' own movement and fire. CAS can be both defensive or offensive, and great care is required as friendlies will be operating near targets.

Air Defence Suppression

The targets of Air Defence Suppression, or Iron Hand missions, are enemy ground positions that pose a threat to friendly aircraft in a specific area. Threats may be Surface-to-Air missile sites (SAMs) or AAA units. Knocking out these defences is vital to allow friendly air forces to operate with impunity, and Air Defence Suppression aircraft are often the first to arrive over a target area and the last to leave. These are usually the most demanding missions.

Armed Reconnaissance

Sometimes referred to as Search and Destroy missions, the primary goal of Armed Reconnaissance is to find and attack targets of opportunity. Mission orders are not specific and any hostile forces within the assigned area, including all types of mobile equipment, should be considered legitimate targets.

Instruments

All of the flyable aircraft modelled in Wings Over Europe share many of the same cockpit instruments. While they may differ slightly in appearance, they function in much the same way, as explained below. The following list is of the basic instruments needed to play the game, and most aircraft will actually have more than presented here (not all instruments present in all aircraft).

1. Airspeed and Mach Number Indicator

A combination airspeed and Mach number indicator. the needle displays the Indicated Air Speed (IAS) in knots on the outside wheel, and an inner dial shows Mach number. The F-4's airspeed indicator is divided into two parts: the right hand side of the gauge measures airspeed up to roughly 200 knots, and the numerals on the left hand indicate a percentage of Mach by tenths. The speed of sound varies according to air density and therefore altitude.

2.. True Airspeed Indicator

A measure of the aircraft's true airspeed (TAS) rather than its indicated airspeed (IAS). TAS is velocity through space, while IAS is a measure of airflow, variable by air density and wind conditions.

3. Altimeter

The altimeter measures altitude above sea level via barometric pressure.

4. Radar Altimeter

This gauge indicates feet about ground level as measured by a radar return.

5. Vertical Velocity Indicator (VVI)

Also known as a Vertical Speed Indicator (VSI), the VVI measures a gain or loss of altitude by hundreds of feet per minute. Numbers on the top of the gauge indicate a climb, numbers on the bottom a descent.

6. Attitude Indicator

Sometimes called a Horizon Ball, this gauge shows the aircraft's orientation relative to the horizon with the sky shown as light blue. Horizontal white lines show pitch in degrees of ten, and fixed hash marks to the outside are used to measure bank angle.

7. Attitude Director Indicator

This instrument works similarly to the Attitude Indicator, but has more detailed information, including a heading reference scale, bank indicator and a turn and slip indicator.

8. Standby Attitude Indicator

A secondary Attitude Indicator in case the first fails.

9. Turn-and-Slip Indicator

This instrument measures bank angle and sliding on the yaw axis.

10. Angle-of-Attack Indicator

A measure of the pitch of the aircraft as divergent from its actual flight path. In other words, it compares the difference between the flight path and the actual pitch.

11. Heading Indicator

A rotating compass card viewed top down.

12. Standby Compass

A secondary compass in case others fail.

13. Radio Magnetic Indicator

This instrument contains a fixed compass card with two rotating pointers. The wide pointer indicates the ground track (heading) of the aircraft, and the narrow pointer indicates bearing to the next waypoint.

14. Position and Homing Indicator (PHI)

The PHI is a basic navigation tool. Consisting primarily of a rotating compass card, it also has a pointer marking the correct bearing to the next waypoint and digital numerals to show the range to it in nautical miles.

15. Horizontal Situation Indicator (HIS)

Found in the F-4 Phantom II, the HIS is a more sophisticated navigation tool. The large pointer just outside of the rotating compass card shows the correct bearing to the next waypoint from the current position. The long arrow bisecting the entire gauge shows the course from the previous waypoint to the next waypoint. The digital numerals on the bottom left side of the gauge measure range to the next waypoint in nautical miles. Lastly, the innermost component measures current course deviation from the line between the previous to next waypoint.

16. Range Indicator

A basic gauge showing range to the next waypoint in nautical miles.

17. Clock

A timepiece set to local time.

18. Accelerometer

This measures the amount of g-forces acting on the aircraft.

19. Internal Fuel Quantity Indicator

A measure of available fuel in all internal tanks.

20. External Fuel Quantity Indicator

A measure of available fuel in external tank(s).

21. Total Fuel Quantity Indicator

A measure of total fuel remaining.

22. Fuel Flow Indicator

A measure of the amount of fuel flow at the current throttle setting (and therefore, consumption).

23. Tachometer

An indicator of engine revolutions per minute, measured as a percentage of total allowable RPM.

24. Engine Nozzle Position Indicator

A gauge to indicate the current aperture of the jet nozzle.

25. Exhaust Gas Temperature Gauge

A measure of the heat of the exhaust from the jet engine. Excessively high heat can indicate an engine malfunction or engine overuse at high settings.

26. Oil Pressure Gauge

An indicator of oil pressure in the engine. An overly low reading signifies a malfunction.

27. Oil Quantity Indicator

A measure of the amount of oil present in the oil receptacle. A low reading could signify a leak, or an overly hot engine. An engine that runs with too little oil will sustain damage and may stop functioning altogether.

28. Hydraulic Pressure Gauge

A measure of the pressure of hydraulic fluids that are used to move control surfaces. A low reading could mean reduced or total loss of control of any or all of the ailerons, elevator and rudder.

29. Caution Light

A master warning light signifying a general malfunction. Check all gauges and systems if lit.

30. Fire Warning Light

An indicator of a fire in the engine.

31. Armament Control Panel

A weapons panel to indicate status of weapons and related systems.

32. Radar Warning Receiver (RWR)

The RWR can detect, identify and characterize radar signals 360 degrees around the plane, displaying threat type and the relative bearing. It can also identify if the threatening radar is in search mode or is tracking the aircraft.

33. Radar Scope

Displays the radar image.

The Radar

Possibly the most complicated instrument in the cockpit, the radar scope can be placed in standby mode to avoid detection by hostile forces and leaving it on for prolonged periods may increase the chance of malfunction. There are four selectable modes of operation: Search, Boresight, Ground Map and Terrain Avoidance. Acquisition and Track modes are sublayers operated automatically by the radar system.

Search Mode

In Search Mode the radar antenna sweeps the sky in front of the aircraft, displayed as a vertical line tracing across the scope. Longer range settings also scan a greater arc vertically. Targets are displayed as a momentary blip on the B-sweep, and a bracketed acquisition bar can be manually cycled through all targets on the scope when the display range selected is within the radar's track range. The radar system can then be ordered to attempt to lock on and track the target with the acquisition symbol, at which point the system will automatically transition to Acquisition mode.

Boresight Mode

Rather than sweeping, in Boresight Mode the radar antenna is fixed on a reference line directly ahead of the aircraft. Any target within +/- 3 degrees of the CAGE gunsight circle is detected, and the radar will automatically go into Acquisition Mode to attempt to lock on and track it.

Acquisition Mode

Acquisition Mode is an automatic transition layer between Search or Boresight modes and Track mode. A Range Gate Strobe will move from the bottom of the display toward the selected target symbol as the system attempts to lock on and track the target. If successful, the radar will then automatically transition to Track Mode.

Track Mode

Once a target is being successfully tracked, Track Mode will display angle and range tracking information and the system will automatically keep the antenna pointed towards the target. As long as the lock is maintained, a radar guided missile can be fired at the target. A large Range Rate Circle will appear in the display with a small break in its perimeter, known as the Vc Gap. The orientation of this gap indicates the rate of closure to the target. When the gap is in the 12 o'clock position, this signals the distance to the target is constant. A clockwise rotation of the gap designates decreasing range, and a counterclockwise rotation an increase. The actual position of the Vc Gap indicates the following:

Position of Gap	Rate of Closure	Position of Gap	Rate of Closure
10:30 (315-deg)	450kts, opening	4:00 (120-deg)	1200kts, closing
11:00 (330-deg)	300kts, opening	5:00 (150-deg)	1500kts, closing
12:00 (360-deg)	0kts	6:00 (180-deg)	1800kts, closing
1:00 (30-deg)	300kts, closing	7:00 (210-deg)	2100kts, closing
2:00 (60-deg)	600kts, closing	8:00 (240-deg)	2400kts, closing
3:00 (90-deg)	900kts, closing	9:00 (270-deg)	2700kts, closing

Ground Map Mode

In Ground Map Mode, the radar will scan the terrain ahead with a PPI sweep, tracing an arc across the face of the scope. Significant terrain contours and any ground targets will be displayed.

Terrain Avoidance Mode

The simplest radar mode, Terrain Avoidance Mode displays any obstacles that lie ahead parallel to the aircraft's current flight path with a clearance plane elevation fixed at 500 feet below. If an object appears in the scope, climbing until it disappears will avoid it.

COMBAT BASICS

Wings Over Europe is a flight simulation, and by nature includes Air-to-Air and Air-to-Ground combat. This section covers the basic knowledge guiding air combat, a necessity for any successful pilot.

Rules of Thumb

There are a few basic rules of thumb that all fighter pilots live by in combat, especially when in gun range. Learn them well, as they may just save your virtual life! The first is "Lose sight, lose the fight." In simple terms, this means always keep your eye on enemy aircraft and constantly analyze their position and orientation relative to yours. The moment you lose sight of a bandit you can no longer tell how it is manoeuvring or if it is threatening your aircraft. Make it your first priority to re-establish sight of it!

A second basic tip is not to fly straight and level in combat. Keeping a constant course makes you easy prey and is very predictable. Also, learn to think in three dimensions: not only do aircraft move about on a horizontal plane, but they can also use the vertical one very effectively. By using vertical manoeuvres, a pilot can easily turn the tables on an opponent that insists on making only flat turns.

A third basic maxim of ACM (Air Combat Manoeuvring) is "Speed is life!" This rule holds true for a couple of reasons, but an important one is that speed can easily be cashed in for altitude. Similarly, a high-flying aircraft can dive to pick up speed and for this reason "Altitude is life!" is also a popular saying. This trade off between altitude and speed is known as "energy." A fighter at a high speed and high altitude is almost untouchable (it has very high energy and therefore lots of options), a low-flying fast aircraft or a slower fighter with altitude both have medium energy (each have a few different options) whereas a low-flying, lowspeed aircraft that has used up all its "E" has next to no options. Needless to say, energy management and keeping your options open is critical in a dogfight.

Using the Lift Vector

As explained in the Flight Basics section, the Lift Vector is the direction in which lift is applied on an airframe. Lift as a force is not only used to counter gravity, but it can also be used in manoeuvres. Since lift is effectively "pushing" your aircraft in a known and constant direction, you can use that force to your advantage. Rolling an aircraft so that your lift vector points towards your target will force you to accelerate towards it; subsequently increasing pitch by pulling back on the stick will then increase your turn rate toward it (subject to certain limits, see below). When following an enemy aircraft, keeping your lift vector on the same plane of motion as your foe can help you turn inside of it and set up a kill.

G-Force

G-Force is the measurement of inertial loads, with 1g being the normal force of gravity. The higher an aircraft's velocity, the easier it is to increase *g* loading during manoeuvres. *g* forces act on both pilots and aircraft, sometimes with negative consequences. Sustained high positive *gs* send blood rushing out of a pilot's head, and can lead to increasingly greyed vision and eventually unconsciousness, known as "black-out." Human beings are much less tolerant to negative *gs*, which force blood into the head and can lead to a condition known as "red-out" as vessels in the eye become engorged and vision is affected. In order to recover from black out or red-out, *g* loads must be reduced to allow more normal blood flow to the brain and eyes. Aircraft can also be damaged if *gs* are allowed to climb too high, even if only for a moment. As airspeed decreases the ability to initiate and hold *g* forces is reduced.

Turn Rate versus Turn Radius

Turn Radius is the size of a circle flown by an aircraft as measured from the centre and decreases as velocity is reduced. While this is an important figure, the fighter that can turn the tightest isn't always at an advantage in a dogfight. Turn Rate—the speed with which the nose changes heading, measured in degrees per second—is even more significant. Since firing air to air weapons is generally done from the forward aspect of a fighter, the rate at which the nose can be brought to bear onto a target is critical. Thus, even though an aircraft may be creating a wider circle than its opponent, if it can travel around that circle more quickly, it is at an advantage. At any given velocity and *g* load, an aircraft has a specific turn radius and turn rate.

Corner Velocity

At high speeds turn rate is limited by the amount of *g* forces that can be sustained. As speed lowers and maximum *gs* are maintained, turn rate increases. This seems ideal but, as mentioned above, as airspeed is reduced, so is the ability to hold *gs*. The slowest speed at which maximum *gs* can be applied is known as Corner Velocity and is the point at which an aircraft has the maximum instantaneous turn rate. Corner Velocity will vary between aircraft and is important to learn, as this is where a fighter will perform at its best. Unfortunately, most aircraft don't have enough thrust to maintain this velocity under maximum *g* loads and will find that their turn rate decays as their speed and hence *gs* decrease. The maximum constant velocity that can be held with the highest steady *g* load is known as Sustained Corner Velocity and results in a steady rate of turn. One of the reasons energy management is critical is so that pilots can temporarily achieve corner velocities above the sustained rate and as close as possible to the instantaneous turn rate.

BASIC MANOEUVRES

Immelman Turn

Named after Max Immelman, a German pilot during the dawn of aerial combat, WWI, this move involves pulling back on the stick and climbing through the vertical as part of a half loop. At the top of the loop, when the aircraft is inverted, the pilot rolls through 180 degrees to be right side up and facing the opposite direction from where the manoeuvre was started. The aircraft finishes at a higher altitude than it began, with a resultant loss in velocity. Useful for changing direction quickly, it can be dangerous when pursued closely since an opponent can easily achieve a firing solution when the plane is slow towards the top of the loop. Insufficient speed before entering an Immelman will result in a stall.

Split-S

The Split-S can be considered the counterpart to the Immelman, since it is also a half loop. However, in this case the pilot rolls inverted before pulling back on the stick and then performs the half loop while descending. The end result is a 180 degree change in direction, a loss of altitude and a gain in airspeed. It is critical that it be performed with sufficient height to avoid flying into the ground. Mainly a defensive move, it can also be used if an opponent flies beneath you in the opposite direction. The half roll is executed before the loop since a pilot can withstand many more positive *gs* than negative ones.

Break Turn

A Break Turn is used to quickly defeat a guns solution by a hostile aircraft that is rapidly closing from the rear aspect. It is executed by banking either right or left and pulling back on the stick rapidly so as to carve a tight turn and force an overshoot. It is imperative to turn into the attacker and not away from him, as the latter would give him an even easier shot. A break turn is best performed level with the horizon or lower to avoid a pop-up in altitude and loss of speed, thus unwittingly becoming an even easier target. Break turns are most effective when the pursuer has a significant speed advantage and therefore cannot pull as tight a turn.

High and Low Yo-Yo

A Yo-Yo, whether high or low, is a very effective offensive tactic against an opponent that insists on making flat turns. Its principle advantage is that by using the vertical plane an aggressor can create an offset path of pursuit and thus gain an angle on the enemy. The Yo-Yo is performed by rolling outside of the horizontal plane during a turn and pitching up or down, followed by an opposite roll back into the original turn. The end result is that you will have effectively "cut the corner" of the flat circle and will find yourself more squarely on your opponent's rear. The High Yo-Yo should be used when you have energy to spare and are above Corner Velocity, while the Low Yo-Yo should be used when you need to gain speed to reach your instantaneous turn rate.

Using the Gunsight

Aircraft like the F-100 Super Sabre and F-4 Phantom II are equipped with a Lead Computing Optical Sight System (LCOSS). This gunsight can be operated in three modes: CAGE, A/A and A/G.

In CAGE mode the gunsight reticle is fixed along the radar boresight line of the aircraft.

When selecting Air-to-Air missiles the LCOSS automatically goes into CAGE mode.

In A/A (Air-to-Air) mode and with the cannon selected, the gunsight is placed in lead computing mode with the reticle position governed by the sight gyro and radar range. By these means the sight effectively predicts where cannon fire will go, given your current *g* load and range to a selected target. Place the predictor sight onto the target and fire guns to hit it.

If no air target is selected, the sight defaults to a range of 1,000 feet.

In A/G (Air-to-Ground) mode, the sight is manually depressible to 245 mil below the fuselage line.

In the F-4 Phantom II, the LCOSS also has roll tabs and a range bar. The range bar moves from roughly the 1 o'clock position (delineating maximum range) to the 6 o'clock (showing minimum range) and reflects different distances according to the weapon selected.

Air-to-Air Missiles

Aerial combat during the Korean War and even into the early 1960s was still very much a visual affair. While bogeys could be plotted on airborne radar at quite a distance, fire control technologies that existed were quite primitive by today's standards and downright unreliable. Heat-seeking missiles had to be fired within very specific parameters, and cannons still proved very effective for in-close fighting. This lesson is evident by the case of the F-4 Phantom II, which began life without any onboard cannon and was overly reliant on missiles; it later had gun pods fitted, and finally had a 20mm Vulcan cannon installed in the nose by 1967.

On board fire control radars of the 1960s could only lock onto one enemy at a time, and radar-homing missiles had to "ride the beam" to their targets, not having their own independent guidance systems.

Heat-Seeking Missiles

Infrared (IR) missiles track the heat signature produced by a jet's exhaust. To be used successfully, they have to be fired from the rear aspect of the target; otherwise, they will not pick up a heat source properly. Early versions were sometimes fooled by other objects that radiate heat against the sky like the sun or clouds. Even the most modern heat-seeking missiles can still be fooled by flares.

When AIM-9 missiles are selected, you will hear a constant medium pitched tone known as a "growl." As the IR seeker head detects and locks onto a source, this pitch will change to a high tone. The sensor of a heat-seeking missile has a limited field of view, so in order to "get a tone," the target has to be roughly within your gunsight (it will have automatically switched to CAGE mode) and within range of the seeker head.

Early Sidewinder missiles could not be fired when pulling too many *gs*. Likewise, a missile also has manoeuvrability limits, and if it is fired from too close a range or too high an aspect angle, it may not be able to turn sharply enough to engage the target. The best way to ensure your missile hits is to have a constant tone and to be following the target in pure pursuit without a high *g* load. The manoeuvrability and/or maximum range of Sidewinder missiles improves with each variant.

If your target is too close to use AIM-9 missiles, use your guns!

Radar-Guided Missiles

Radar-homing missiles (RHM) rely on information from a radar signature to find their way to a target. They operate at a much greater range than heat-seeking missiles and can be fired from any aspect, meaning you do not have to manoeuvre to the rear of a bandit.

While in flight, they require radar information constantly provided by the launching aircraft.

Unlike a heat-seeking missile which is "fire and forget", their guidance depends on a radar lock being kept by your Phantom II and the target being illuminated. At longer ranges this can be defeated by enemy radar jamming, and only one target can be illuminated at a time. Hostile aircraft can also employ chaff defensively to defeat radar locks.

F-15 APG-63 RADAR OPERATION (Avionics Option on Normal or Hard)

Four modes available are:

- Search
- Track-While-Scan (TWS)
- Single Target Track (STT)
- Auto Acquisition

Key Commands

Cycle Radar Mode keys (default: "PageUp" and "Shift PageUp" for next/prev) cycles through the modes except STT mode. (ie, *Search* -> *TWS* -> *Auto Acquisition*).

Cycle Radar Range keys (default: "PageDown" and "Shift PageDown" for next/prev) cycles through different range settings (available on F-15: 10, 20, 40, 80, 160 nm)

Select Radar Target keys (default: "Home" and "Shift Home" for next/prev) cycles through displayed targets and designate a target by moving the acquisition bars over it. Available on *Search* and *TWS* modes only. Once the target is designated, it can be locked-on to by pressing *Acquire Radar Target* key.

Acquire Radar Target key (default: "Insert") key to lock on to the designated target from *Search* and *TWS* modes and switch to *STT* mode.

Search Mode

Search mode has the widest search volume and fastest search time, but only shows minimum information regarding targets. Shows top-down view displaying radar contacts' azimuth and range relative to the radar. Target can be selected using **Cycle Radar Target** keys, and **Acquire Radar Target** key switches to *STT* mode.

Track-While-Scan (TWS) Mode

TWS mode displays additional information about the currently designated target while still showing basic azimuth/range info on other targets. Radar in *TWS* mode scans slightly smaller volume than in *Search* mode, and radar elevation is automatically centred on the currently highlighted target. Shows top-down view displaying radar contacts' azimuth and range relative to the radar, and target symbol may have a vector to show its movement direction. Different targets can be selected using **Cycle Radar Target** keys, and **Acquire Radar Target** key switches to *STT* mode. Additional info may be displayed depending on the current air-to-air weapon type selected.

Radar targets symbols while in *TWS* mode:

If Avionics Option is set to Hard, it takes the radar 3 hits before it can gather enough information needed to show target vector and IFF info on non-designated target.

Single Target Track (STT) Mode

STT mode displays the all the same information as the TWS about a single target, but does not display any other targets. Radar can be used to guide radar-guided missiles (AIM-7 Sparrow) from this mode. Shows top-down view displaying radar contacts' azimuth and range relative to the radar, and target symbol has a vector to show its direction. Additional info may be displayed depending on the current air-to-air weapon type selected.

Auto Acquisition Mode

Radar in *Auto Acquisition* mode only displays basic radar operation info, and does not display any target info. The radar scans straight ahead and vertically from 0 to 55 deg above the boresight line. It automatically locks on to the first target it encounters in its search arc, and switches to STT mode.

A-10 AND F-4 SMART WEAPONS OPERATION (Weapons Option on Normal or Hard)

Two types of "smart" air-to-ground guidance available are:

- Electro-Optical (EO) – AGM-65 Maverick, GBU-8 HOBOS, and Walleye
- Laser-guided – GBU-10/12 Paveway I

Key Commands

Cycle A/G Weapons keys (default: "#" and " Shift #" for next/prev) cycles through air-to-ground weapons onboard.

Select Ground Target keys (default: "E" and " Shift E" for next/prev) cycles through nearby targets.

Fire Selected Weapon key (default: "Enter") fires the selected weapon at the currently selected target.

Electro-Optical (EO) Guided Weapon

Once EO guided weapon is selected, the radarscope will display the image seen by the EO seeker of the selected weapon. To use EO guided weapon, select the visual target by hitting **Select Ground Target** key. If the target is in seeker range and in seeker field-of-view, the display will show the weapon seeker tracking the target, and the Heads-Up-Display will display a symbol indicating where the weapon is locked on to. Press **Fire Selected Weapon** key to fire. EO guided weapons are "fire-and-forget", and you can immediately switch to next target or next weapon without losing guidance. The actual EO display may be different depending on the weapon and aircraft.

Laser-Guided Weapon

If the aircraft is not carrying Laser Designator (A-10), the player cannot select target, he can only attack primary targets already pre-designated by other laser designators (such as ground troops). The Heads-Up-Display will display a symbol indicating where the laser is designating. Press **Fire Selected Weapon** key to fire. Since the target is being lased by other units, player does not have to maintain target, and can immediately switch target to attack using another weapon.

If the aircraft is carrying Laser Designator (AVQ-23 Laser Designator Pod on F-4), the radarscope will display an image similar to EO guided weapon, and the player can select the visual target by hitting **Select Ground Target** key. If the target is in designator range

and in designator field-of-view, the display will show the designator tracking the target, and the Heads-Up-Display will display a symbol indicating where the laser is currently designating. Press **Fire Selected Weapon** key to fire. Laser-guided weapons are NOT "fire-and-forget", and the target must remain selected until the weapon impact.

Harrier Thrust Vectoring

Harrier can take-off vertically when lightly loaded with fuel and weapon. It can also land vertically, after its fuel and ordnances are expended.

Key Commands

Thrust Vector control (default keys are "Control Numpad+" and "Control Numpad-") rotates the engine nozzles, and they can be mapped to other ranged control (such as rotation axis on joystick) on Control Menu on the Options Screen.

DEFAULT KEY COMMANDS

The game has a default set of key commands. You can alter them by opening the Options Screen. Click the green aircraft icon in the upper left corner of the screen, then select Control. The default control list is loaded by default, but you can click Customize to change the key mappings. If you choose to customize, a new *.INI file will be saved in the Controls subdirectory under the main game folder.

In-flight Keyboard Commands

Esc	End/abort mission and display the Debrief Screen.
Alt+Q	Close the game immediately and return to the desktop.
Alt+P	Pause the game. (You can still perform many functions while the game is paused.)
Alt+T	Change the rate at which time passes - x2 (twice as fast), x4 (four times as fast), x8 (eight times as fast) and x1 (normal speed).
Alt+R	Reset time compression back to x1.
Alt+N	Jump to the next mission encounter. You can use this option only when no enemy targets are present. When pressed, this key takes you to the next action area and eliminates all travel time (including waypoints).
Tab	Display the radio communication menu. You can then press the number keys (1 through 9 at the top of the keyboard) to select a specific menu or message.
` (Accent Grave)	Initiate chat mode in multiplayer play. Once in chat mode, all keyboard functions cease to operate, and all keys are sent to the chat window. (Your joystick and mouse, however, work normally.) ESC aborts message and exits chat mode. Enter sends the chat message to all team members and exits chat mode.

Shift+` (Accent Grave)	Initiate a chat with an enemy player.
Ctrl+` (Accent Grave)	Initiate a chat with a friendly player.
Alt+` (Accent Grave)	Initiate a chat with the closest visual target.
A	Toggle autopilot on/off. In Autopilot mode, your aircraft flies toward the next waypoint. Note that moving the joystick or mouse will cancel autopilot. Autopilot also does not pause for enemy encounters.
Shift+A	Toggle wing-levelling action. When activated, this feature restores level flight and keeps the aircraft moving in a straight line. If you move the joystick or mouse while this function is active, the game will drop out of wing-levelling mode.
W	Select next waypoint.
Shift+W	Select previous waypoint.
M	Display the in-flight map, a version of the Planning Map, but with less information. It basically shows your current position and the position of known mission-critical objects.
PrtScrn	Take a screen shot. The current scene will be saved as a bitmap image in the ScreenShots folder.

Commands

Note: In all interior views, you can move the mouse to pan the view up, down, left and right.

F1	Display the interior, front cockpit view.
F2	Turn your head left and display the view out of the left side of the cockpit.
F3	Turn your head right and display the view out of the right side of the cockpit.
Shift+F1	Show a front 45-degrees-up view from inside the cockpit.
F4	Toggle the padlock view, keeping the selected target in your view as long as it's in range. This option attempts to keep your current foe centred in your view. Pressing this key a second time switches the view back to front cockpit view (F1).
Numpad Keys	Temporarily pan the view in a given direction. The view returns to its previous position when you release the key.
Numpad Del (.)	Toggle cockpit art on/off, leaving only the HUD targeting circle.
Numpad 0	Display a forward view of the dashboard, looking down at the instruments.
Numpad 8	Display the forward view.
Numpad 7/4/1	Display the left front/left/left rear view, respectively.
Numpad 9/6/3	Display the right front/right/right rear view, respectively.
Numpad 5	Add 45 degrees of vertical angle to any other view. (Press this key in conjunction with the other Numpad view keys.)

F5	Display an external, over-the-shoulder view. Use this view to "check six" (look behind you).
F6	Cycle through external views of various aircraft in the mission. Pressing this key multiple times in succession switches to the next aircraft.
Shift+F6	As above, but in reverse order. Pressing this key multiple times switches to the previous aircraft.
F7	Display an external view of the next ground object. Pressing this key multiple times switches to the next ground object.
Shift+F7	As above, but in reverse order. Pressing this key multiple times switches to the previous ground object.
F8	Display an enlarged view of your current visual target.
Shift+F8	Show a line-of-sight view to your target. This perspective puts your current target in the centre of the screen and lines it up with an external view of your aircraft in the foreground.
Ctrl+F8	As above, but reversed. Your aircraft appears in the middle of the screen, and the target appears in the foreground.
F9	Switch to the weapon camera view. You view everything from the weapon's perspective, corresponding to the last weapon you fired.
Shift+F9	Show a line-of-sight view from your weapon to your aircraft. This perspective puts your weapon in the centre of the screen and lines it up with an external view of your aircraft in the foreground.
Ctrl+F9	As above, but reversed. Your aircraft appears in the centre of the screen, and your weapon appears in the foreground.
F10	Display an external, fly-by view. You see your aircraft make an approach, fly past, and then exit your view.
F11	Display the view from the nearest tower to your aircraft.
Numpad +/-	Zoom the camera view in (+) or out (-). You can also use the wheel on your mouse if it's equipped with one.
Alt+Arrow keys	Pan the view in the desired direction. You can also move the mouse in any direction to pan.
L/R Mouse Buttons	Zoom view in or out. This can be useful for examining your aircraft from an external camera view, or for reading dashboard instruments.

Flight Control Commands

You can control your aircraft by using a joystick or the keyboard. If you have a programmable joystick, many of the following functions can be assigned to your joystick buttons and/or wheels.

Note that the aircraft takes a few seconds to respond to your flight commands. Be careful not to over steer, or you may quickly get into trouble.

Ctrl+= / -	Rotate thrust vector on the Harrier.
Left/Right Arrow Keys	Roll the aircraft (dip the wings) left or right.
Up/Down Arrow Keys	Pitch the nose of the aircraft up or down.
,/. (Comma/Period)	Turn the rudder left and right. Alternatively, you can also use a rudder pedal.
=/- (Not Numpad)	Increase or decrease throttle. Note that you can also use an external throttle to control speed.
F	Extend flaps down by one notch. Most aircraft flaps have three settings. Up (Retracted) - no extra lift (good for normal flight) 1/3 (Partially extended) - some extra lift (good for taking off and avoiding stalls during tight or vertical manoeuvres) Down (Fully extended) - lots of extra lift and drag (good for landing)
V	Retract flaps by one notch. Flaps are automatically raised after you reach a certain speed in order to prevent damage.
S	Toggle speedbrakes (extend/retract). Use your airbrakes in the air to quickly bleed off speed.
B	Toggle wheel brakes (engage/disengage). Use this command when landing to reduce speed, but make sure you wait until you've touched down.
G	Raise/lower landing gear.
Ctrl+L	Cycle through external navigation light settings - off/flashing/steady.
Shift+ESC	Eject from the aircraft.

Weapons Commands

Backspace	Switch to next Air-to-Air (A/A) weapon.
Shift+Backspace	Switch to previous Air-to-Air weapon.
# (Hash)	Switch to next Air-to-Ground (A/G) weapons.
Shift+# (Hash)	Switch to previous Air-to-Ground weapon.
Spacebar	Fire primary gun or cannon. You can also use joystick button 1 to fire.
Enter	Fire/release currently selected missile, bomb, or rocket. You can also use joystick button #2.
Ctrl+D	Jettison (drop) external fuel tanks. You can do this to gain manoeuvrability, as long as you have enough fuel to return to base.

Ctrl+J	Jettison all external weapons except for A/A missiles.
' (Apostrophe)	Switch to next gunsight mode - CAGE/Air-to-Air (A/A)/Air-to-Ground (A/G). Whenever you select a new weapon, the proper gunsight mode autoactivates.
Shift+' (Apostrophe)	Switch to previous gunsight mode.
]	Cycle to next ripple setting. For bombs, this key determines the ripple setting, or how many bombs are released at once when you press Enter. The number of weapons per launch varies by aircraft.
Shift+]	Cycle to previous ripple or salvo setting.
[Cycle to next ripple interval setting. This determines the time between each bomb release when more than one bombs are rippled.
Shift+[Cycle to previous ripple interval setting.
; (Semicolon)	Cycle to next gun group - usually 2 upper guns/2 lower guns/all 4 guns. Some aircraft have multiple gun groups or gun pods. Pressing this key activates a different set of guns. When you press the Spacebar, only the selected guns will fire rounds.
Shift+; (Semicolon)	Cycle to previous gun group setting.
Z	Toggle electronic counter measures (ECM) on/off. For aircraft equipped with an ECM, this can jam the enemy radar. However, it gives away your location to the enemy.

Radar Commands

Ctrl+PgUp	Turn radar off. If the radar is off, pressing PgUp will turn it on.
PgUp	Switch to next radar mode - Search/Boresight/Ground Map/Terrain Avoidance. Note that not all modes are available on all aircraft. Additionally, the Gameplay option settings can affect what you see on the radar. When the radar is in Acquisition or Tracking mode, this key instead causes the radar to revert back to its pre-acquisition setting (either Search or Boresight mode).
Shift+PgUp	Cycle to previous radar mode.
PgDn	Cycle to next radar range setting. Note that different aircraft have different radar ranges.
Shift+PgDn	Cycle to previous radar range setting.
Home	Select the next radar target on the radar display. Depending on your Gameplay option settings, the radar target may only appear as a momentary blip during each sweep. A target must be visible in order for the radar to enter Acquisition mode.

Shift+Home	Cycle to previous radar target on the radar display.
Insert	Acquire and lock on the currently selected target. Acquisition mode is a transitional mode between Search mode and Track mode. Once you initiate acquisition, you lose all other radar contacts. When the radar is able to acquire a full system lock, it enters Tracking mode. You can then fire your radar-guided missile at the selected target.
Shift+Insert	Attempt to acquire the current visual target. This slews the radar azimuth and elevation in order to point at the visual target. If the target falls within the radar constraints, the radar tries to enter Acquisition mode and acquire that target.
Delete	Deselect the current radar target. This key causes the radar to go back into Search or Boresight mode. Note that you can also deselect a target by cycling through radar modes.

Visual Targeting Commands

T	Designate the next enemy or unidentified aircraft as your visual target. This places square brackets on the Heads-Up Display (HUD). If the target moves out of view, the brackets turn into a cone that points in the direction of the target. Additional target information may also appear in the lower right corner of your viewscreen, depending on your HUD settings.
Shift+T	Select previous enemy or unidentified aircraft as your visual target.
Ctrl+T	Select closest enemy or unidentified aircraft as your visual target.
Y	Select next friendly or neutral aircraft as your visual target.
Shift+Y	Select previous friendly or neutral aircraft as your visual target.
Ctrl+Y	Select closest friendly or neutral aircraft as your visual target.
E	Select next enemy ground object as your visual target.
Shift+E	Select previous enemy ground object as your visual target.
Ctrl+E	Select closest enemy ground object as your visual target.
Numpad * (Asterisk)	Target the object closest to the centre of view.

R	Target the last object mentioned in the radio call - an enemy aircraft (bandit), incoming missile, friendly bomber, airport, etc. For radio calls that do not involve targetable objects, the caller of the object, if appropriate, may be targeted. Some objects might not be visible or targetable.
Shift+R	Target the caller of the last radio call, if appropriate.
Ctrl+R	Select the current radar target as your visual target. You must have the target selected on your radar, but you don't need a full lock to select this as a visual target.

TECHNICAL SUPPORT

Please be sure to read any README files contained on the game CD before attempting installation.

Should you encounter any problems with this product, check out the Empire website first. It contains the most up to date information together with any patches or downloads that may be available.

<http://support.empireinteractive.com/default.aspx>

If you have a specific problem that is not covered by our website, you can contact us using any of the following methods. Please be sure to have the following information to hand when contacting us;

- Manufacturer of your computer system
- Brand and speed of the processor
- How much RAM you have
- Version of Windows you are using (if you are unsure, right-click on the My Computer icon, and select properties)
- Manufacturer and model of your video and sound cards.

Email: support@empire.co.uk
with the name Wings Over Europe in the subject field of the email

Telephone: 087 00 34 44 00
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